VERIFICATION OF TRANSLATION

I, Tae-Ho Ha of 9th Fl. Seoyoung Bldg., 158-12, Samsung-dong, Kangnam-gu, Seoul, 135-090, Korea, declare that I have a thorough knowledge of the Korean and English languages, and the writings contained in the following pages are correct English translation of the specification and claims of Korean Patent Application No. 2000-0064739.

This 3rd day of February, 2005

By:

[Tae-Ho Ha]

KOREAN INTELLECTUAL

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[TITLE OF INVENTION IN ENGLISH] method for fabricting a Transflective liquid crystal display device and the same

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[PURPORT] We submit application as above under the article 42 of the Patent Law.

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[FEES]

[BASIC APPLICATION FEE]	20 pages	29,000	Won
[ADDITIONAL APPLICATION FEE]	18 pages	18,000	Won
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[ENCLOSED] 1. Abstract, Specifications (with Drawings) - 1 set

[DOCUMENT OF ABSTRACT]

[ABSTRACT]

The present invention relates to a liquid crystal display (LCD) device, and more particularly, to a transflective LCD device including both a reflective portion and a transmissive portion in a pixel region.

It is the objectives of the present invention to provide a structure that galvanic phenomenon between a reflective electrode and a transparent electrode does not occur and improve production efficiency of the LCD device.

[REPRESENTATIVE FIGURE]

FIG. 7c

[SPECIFICATIONS]

[NAME OF INVENTION]

Method for fabricating a Transflective liquid crystal display device and the same

[BRIEF EXPLANATION OF FIGURES]

FIG. 1 is an exploded perspective view illustrating a portion of a typical transflective LCD device;

FIG. 2 is a cross-sectional view illustrating a typical transflective LCD device;

FIG. 3 is an expanded plan view illustrating some pixels of an array substrate for a conventional transmissive LCD device;

FIGs. 4a to 4d are sequential processing cross-sectional views taken along lines II-II`, III-III` and IV-IV` of FIG. 3;

FIGs. 5a to 5d are sequential processing cross-sectional views taken along lines II-II`, III-III` and IV-IV` of FIG. 3 according to a first embodiment of the present invention;

FIGs. 6a to 6c are sequential processing cross-sectional views taken along lines II-II`, III-III` and IV-IV` of FIG. 3 according to a second embodiment of the present invention; and

FIGs. 7a to 7c are sequential processing cross-sectional views taken along lines II-II`, III-III` and IV-IV` of FIG. 3 according to a third embodiment of the present invention.

* Explanation of major parts in the figures *

163 : transparent electrode

166 : first reflective electrode

168 : second reflective electrode

[DETAILED DESCRIPTION OF INVENTION]

[OBJECT OF INVENTION]

[TECHNICAL FIELD OF THE INVENTION AND PRIOR ART OF THE FIELD]

The present invention relates to a liquid crystal display (LCD) device, and more particularly, to a transflective LCD device using selectively a transmissive mode a reflective mode.

Generally, a transflective LCD device has advantages of both a transmissive LCD device and a reflective LCD device. Because the transflective LCD device uses a back light as well as an exterior natural light source or an artificial light source, it is not dependent upon exterior light source conditions, and consumes relatively low power.

FIG. 1 is an exploded perspective view illustrating a typical transflective LCD device.

As shown, the typical transflective LCD device 11 includes an upper substrate 15 having a common electrode 13 formed on a black matrix 16 a sub-color filter 17, and a lower substrate 21 having a pixel electrode 19 having a transmissive region A and a reflective region C, a switching element T and an array line. A liquid crystal 23 is interposed between the upper substrate 15 and the lower substrate 21.

FIG. 2 is a cross-sectional view illustrating a typical transflective LCD device.

As shown, the schematic transflective LCD device 11 includes a upper substrate 15 having the common electrode 13, a lower substrate 21 having a pixel electrode 19 having a reflective electrode 19b having a through-hole A and a transparent electrode 19a, a liquid crystal 23 interposed between the upper substrate 15 and the lower substrate 21, and a back light 41 disposed below the lower substrate 21.

When the above transflective LCD device 11 is operated in a reflective mode, an exterior natural light source or an exterior artificial light source is used.

With reference to the above-explained structure, operations of the transflective LCD device for the reflective and transmissive modes will be explained

For the reflective mode, the transflective LCD device uses an exterior natural light source or an exterior artificial light source. The incident light "B" passes through the upper substrate 15 and is reflected by the reflective electrode 19b back through the liquid crystal 23, which is aligned by the application of an electric field between the reflective electrode and the common electrode 13. Accordingly, the aligned liquid crystal 23 controls the incident light "B" so as to display an image.

To the contrary, for the transmissive mode, the transflective LCD device uses a light "F", which radiates from the back light 41. The light "F" passes through the transparent electrode 19a to the liquid crystal 23, which is aligned by the application of an electric field between the transparent electrode 19a and the common electrode 13 below the through-hole. Accordingly, the aligned liquid crystal layer 23 controls the light "F" so as to display an image.

FIG. 3 is an expanded plan view illustrating a portion of an array substrate as a lower substrate.

A lower substrate 22 is referred to as an array substrate, and thin film transistors T as switching elements are arranged in a matrix type. The thin film transistor T is disposed where a gate line 25 and a data line 27 cross each other.

At this time, the gate line 25 and the data line 27 crossing each other define a pixel region P.

A storage capacitor S is disposed on a portion of the gate line 25, and is electrically connected in parallel to a pixel electrode disposed in the pixel region.

A gate pad 29 and a data pad 31 are disposed at one ends of the gate line 25 and data line 27, respectively.

The thin film transistor T includes a gate electrode 32, a source electrode 33, a drain electrode 35 and an active layer 34 on the gate electrode.

At this time, the transmissive pixel electrode 19 includes a transparent electrode and a reflective electrode having a through-hole, and is divided into a transmissive portion A and a reflective portion B.

Hereinafter, with reference to FIGs. 4a to 4d, a structure and a fabricating method of FIG. 3 is simply explained.

FIGs. 4a to 4d are sequential processing cross-sectional views taken along lines II-II`, III-III` and IV-IV` of FIG. 3.

At first, as shown in FIG. 4a, a gate electrode 32, a gate line 25 and a gate pad 29 of a predetermined area at one end of the gate line are formed on a substrate 22, and then a gate-insulating layer 43 is formed on the substrate having the gate line et al..

Next, a semiconductor layer is formed on the gate-insulating layer 43 over the gate electrode 32, and includes an active layer 45 of amorphous silicon and an ohmic contact layer 47 of impurity-doped amorphous silicon which have island-shape and overlap each other in plane.

Next, a source electrode 33 and a drain electrode 35 on the ohmic contact layer 47, a data line (27 in FIG. 3) extended perpendicularly to the source electrode 33 and a data pad 42 of a predetermined area at one end of the data line are formed.

At the same time, a source-drain metal layer 49 having island-shape is formed on a portion of the gate line 25 defining the pixel region (P in FIG. 3).

Next, as shown in FIG. 4b, an insulating material is deposited on the substrate 22 having the data line (27 in FIG. 3) et al. to form a first passivation layer 51.

Next, the first passivation layer 51 is patterned to form a first drain contact hole 53 exposing the drain electrode 35, and a portion of the first passivation layer defined as a transmissive portion of the pixel region is etched to form an etching hole 55.

At the same time, a first storage contact hole exposing the source-drain metal layer 49 is formed, a first gate pad contact hole 59 exposing the gate pad 29 and a first data pad contact hole 61 exposing the data pad 42 are formed.

Next, a transparent conductive metal such as indium-tin-oxide (ITO) and indium-zinc-oxide (IZO) is deposited on the first passivation layer 51 having the contact holes and patterned to form a pixel electrode 63. One side of the pixel electrode contacts the drain electrode 35, and the pixel electrode passes through the pixel region (P in FIG. 3), is extended toward a portion over the gate line 25, and contacts the source-drain metal layer 49 through the first storage contact hole 57.

The source-drain metal layer 49 contacting the pixel electrode 63 acts as a second storage electrode, and the source-drain metal layer and the gate line 25 as a first storage electrode constitute a storage capacitor S.

At the same time, a gate pad terminal electrode 65 connected to the gate pad 29 through the first gate pad contact hole 59 and a data pad terminal 67 connected to the data pad 42 through the first data pad contact hole 61 are formed.

As shown in FIG. 4c, an insulating material is deposited entirely on the substrate having the patterned transparent electrode to form a second passivation layer 69. The second

passivation layer 69 is patterned to form a second drain contact hole 53` exposing the transparent electrode 63 contacting the drain electrode 35, and a portion of the second passivation over the first storage contact hole is etched to form a second storage contact hole 57`.

An opaque conductive metal having good resistance and reflectance such as aluminum (Al) or aluminum alloy (AlNd) is deposited on the second passivation layer 69 having the contact holes and patterned to form a reflective electrode 71. The reflective electrode 71 has a through-hole at a position corresponding to the etching hole (55 in FIG. 4b). One side of the reflective electrode 71 contacts the transparent electrode 63 through the second drain contact hole 53`, and other side of that contacts the transparent pixel electrode 63 contacting the source-drain metal layer 49 through the second storage contact hole 53`.

Next, as shown in FIG. 4d, the exposed second passivation layer 69 is patterned to form a second gate pad contact hole 59` and a second data pad contact hole 61` exposing the gate pad terminal electrode 65 and the data pad terminal electrode 67, respectively.

Through the above method, an array substrate for the conventional transflective LCD can be fabricated.

In the above processes, the reason for etching the first passivation layer 51 corresponding to the transmissive portion (A in FIG.3) of the pixel region (P in FIG. 3) and the gate-insulating layer 43 therebelow is to match light-passing distances through the transmissive portion (A in FIG. 3) and the reflective portion B, and to get the uniform color purity of the light according to each mode. (At this time, the gate-insulating layer may not be etched according to a process condition)

Furthermore, the reason for disposing the second passivation 69 between the transparent pixel electrode 63 and the reflective electrode 61 is to prevent the electrode

corrosion caused by transition phenomenon between the transparent pixel electrode 63 and the reflective electrode 71 due to the etching solution for the reflective electrode 71.

The corrosion phenomenon is referred to as galvanic corrosion. As explained more particularly, when different kind of metals are dipped in a solution, voltage difference is caused, and thus the phenomenon that an electron moves therebetween occurs.

According to this phenomenon, the contacted metals are corrosive, and thus contacting resistance between the two electrodes is affected adversely.

Therefore, as explained above, the second passivation layer 69 further is formed between the above two electrodes.

However, when the passivation is disposed between the two electrodes, as explained above, a mask process to pattern the passivation layer and a mask process to expose the gate pad terminal electrode 65 and the data pad terminal electrode 67 after patterning the reflective electrode 71 further are added.

As explained more particularly, since each terminal electrode over the gate pad portion and the data pad portion is formed using the transparent electrode instead of the reflective electrode, a process exposing each pad portion is added to prevent reaction with the reflective electrode.

Therefore, since a fabricating method of the array substrate for the transflective LCD device according to the conventional method needs multiple processes, production efficiency of the LCD device is reduced in view of time and cost.

[TECHNICAL SUBJECT OF INVENTION]

Therefore, to settle the above problems, it is the objectives of the present invention to provide an array substrate for a transflective LCD device and fabrication method thereof,

which prevent galvanic corrosion between a transparent electrode and a reflective electrode constituting a pixel electrode through low cost and process simplification.

[CONSTRUCTION AND OPERATION OF INVENTION]

To achieve the objectives of the present invention, a fabricating method of an array substrate for a liquid crystal display device according to a first characteristic of the present invention includes preparing a substrate; forming a thin film transistor on the substrate including a gate electrode, a source electrdoe, a drain electrode and an active layer; forming a data line extended from the source electrode and having a data pad at an end thereof; forming a gate line extended from the gate electrode and having a gate pad at an end thereof; depositing an insulating material on the substrate having the data line to form and pattern a first passivation layer, thereby forming a drain contact hole exposing the drain electrode, a gate pad contact hole exposing the gate pad and a data pad contact hole exposing the data pad; depositing and patterning a tranparent electrode on the first passivation layer, thereby forming a pixel electrode contacting the drain electrode through the drain contact hole at one side thereof, a gate pad terminal electrode contacting the gate pad through the gate pad contact hole and a data pad terminal electrode contacting the data pad throught the data pad contact hole; forming and patterning a second passivation layer of an insulating material on the patterned transparent electrode, thereby exposing a portion of the pixel electrode contacting the drain electrode; forming a reflective electrode having a through-hole on the second passivation layer over the pixel electrode and contacting the exposed pixel electrode; and etching the exposed second passivation layer using the reflective electrode as an etching stopper, thereby exposing the gate pad terminal electrode and the data pad terminal electrode.

The transparent electrode is one selected of a transparent conductive metal group including indium-tin-oxide and indium-zinc-oxide.

The reflective electrode is one selected of a conductive metal group including aluminum (Al) and aluminum alloy (AlNd) having a good reflectance and a low resistance.

The above fabricating method may further include etching the passivation layer at a position corresponding to the thorugh-hole of the reflective electrode.

In the above fabricating method, the etching process of the second passivation layer to expose the gate pad terminal electrode and the data pad terminal electrode uses a dry etching process.

An array substrate for an liquid crystal display device according to another characteristic of the present invention includes a substrate; a gate line and a data line on the substrate crossing each other to define a pixel region and including a gate pad and a data pad, respectively; a switching element at the cross of the gate line and the data line; a transflective pixel electrode including a transparent electrode on the pixel region and a double-layered reflective electrode on the transparent electrode including a through-hole and having a first layer not reacting with the transparent by an etching solution; and a passivation layer below the transparent electrode, a portion of the passivation layer corresponding to the through-hole etched with a predetermined depth.

In this structure, a second passivation layer of an insulating layer may be formed between the transparent electrode and the reflective electrode.

A fabricating method of an array substrate for a liquid crystal display device according to another characteristic of the present invention includes preparing a substrate; forming a thin film transistor on the substrate including a gate electrode, a source electrdoe, a drain electrode and an active layer; forming a data line extended from the source electrode and having a data

pad at an end thereof; forming a gate line extended from the gate electrode and having a gate pad at an end thereof; forming and patterning a passivation layer of an insulating material on the substrate having the data line, thereby forming a drain contact hole exposing a portion of the drain electrode, a gate pad contact hole exposing the gate pad and a data pad contact hole exposing the data pad; depositing and patterning a tranparent electrode on the passivation layer, thereby forming a pixel electrode in the pixel region contacting the drain electrode through the drain contact hole at one side thereof, a gate pad terminal electrode contacting the gate pad through the gate pad contact hole and a data pad terminal electrode contacting the data pad throught the data pad contact hole; depositing and patterning a conductive metal on the patterned transparent electrode having a good reflectance and a low resistance, thereby stacking a first reflective electrode layer on the pixel electrode having a strong corrosion resistance and a second reflective electrode layer on the first reflective electrode layer having a low resistance and a high reflectance; and etching the first reflective electrode layer and the second reflective electrode layer, respectively, using different etching solutions from each other, thereby forming a reflective electrode including a first reflective electrode and a second reflective electrode stacked on the pixel region including a through-hole, and at the same time exposing the gate pad terminal electrode and the data pad terminal electrode.

The above fabricating method further includes forming a passivation layer between the transparetn electrode and the first reflective electrode, and thus an array for a liquid crystal display device may be fabricated.

The first reflective electrode of the double-layered reflective electrode is one selected of a conductive metal group including chromium, molybdenum and tungsten having a strong corrosion resistance.

The etching solution patterning the first reflective electrode is an acid-mixed solution

mixing ceric ammonium nitrate and nitric acid.

The second reflective electrode of the double-layered reflective electrode is one selected of a conductive metal group including aluminum and aluminum alloy having a good reflectance and a low resistance.

The etching solution patterning the second reflective electrode is an acid-mixed solution of phosphoric acid (H_3PO_4), acetic acid (CH_3COH) and nitric acid (HNO_3).

The transparent electrode is one selected of a transparent conductive metal group including indium-tin-oxide and indium-zinc-oxide.

Reference will now be made in detail to embodiments of the present invention, which is illustrated in the accompanying drawings.

-- First embodiment --

A first embodiment of the present invention provides a method exposing a gate pad terminal electrode and a data pad terminal electrode using a reflective electrode as an etch stopper after patterning the reflective electrode without separate exposing process in the exposing process of the gate pad terminal electrode and the data pad terminal electrode.

Hereinafter, it is explained with reference to FIGs. 5a to 5d. (A plan view of the present invention is equal to the conventional plan view and thus uses it, and the reference number of the same elements will be used adding 100 to the conventional reference number for convenience.

At first, as shown in FIG. 5a, a gate electrode 132 and a gate line 125, which have a single-layered structure of aluminum (Al), aluminum alloy (AlNd), tungsten (W), chromium (Cr) and molybdenum (Mo) et al. or a double-layered structure of aluminum (Al)/chromium

(Cr) (or molybdenum (Mo)) et al., are formed on the substrate 111. The gate line 125 has a gate pad 129 at its end portion.

Since the gate electrode 132 material is important to operate the LCD device, aluminum having low resistance is mainly used to reduce RC delay. However, pure aluminum is chemically weak corrosion resistance and may result in line defects by formation of hillocks during posterior high temperature processing. Accordingly, when aluminum for a line used, the metal alloy or the stacking structure as explained above is applied.

Next, one of an inorganic insulating material and an organic insulating material is deposited or coated on the substrate having the gate line et al. to form a gate-insulating layer 143. The inorganic insulating material includes silicon nitride (SiN_X) and silicon oxide (SiO_2), and the organic insulating material includes benzocyclobutene (BCB) and acrylic resin.

Next, a semiconductor layer is formed on the gate-insulating layer 143 over the gate electrode 132, and includes an active layer 145 of amorphous silicon and an ohmic contact layer 147 of impurity-doped amorphous silicon which have island-shape and overlap each other in plane.

Next, one of the above-explained conductive metal materials is deposited on the ohmic contact layer 147 and patterned to form a source electrode 133 and a drain electrode 135, and a data line (not shown) extended perpendicularly to the source electrode 33.

At the same time, a source-drain metal layer 149 having island-shape is formed on a portion of the gate line defining the pixel region (P).

Next, as shown in FIG. 5b, the above-explained insulating material is deposited on the substrate 111 having the data line et al. to form a passivation layer 151.

Next, the passivation layer 151 is patterned to form a first drain contact hole 153 exposing the drain electrode 135, and a portion of the first passivation layer defined as a transmissive portion (A in FIG. 3) of the pixel region is etched to form an etching hole 155.

At the same time, a storage contact hole 157 exposing the source-drain metal layer 149 is formed, a first gate pad contact hole 159 exposing the gate pad 129 and a first data pad contact hole 161 exposing the data pad 142 are formed.

Next, a transparent conductive metal such as indium-tin-oxide (ITO), indium-zinc-oxide (IZO) and indium-tin-zinc-oxide (ITZO) is deposited on the passivation layer 151 having the contact holes and patterned to form a pixel electrode 163. One side of the pixel electrode contacts the drain electrode 135, and the pixel electrode passes through the pixel region (P in FIG. 3), is extended toward a portion over the gate line 125, and contacts the source-drain metal layer 149 through the storage contact hole 157.

The source-drain metal layer 149 contacting the pixel electrode 163 acts as a second storage electrode, and the source-drain metal layer and the gate line as a first storage electrode constitute a storage capacitor.

At the same time, a gate pad terminal electrode 165 connected to the gate pad 129 through the first gate pad contact hole 159 and a data pad terminal 167 having island-shape connected to the data pad 142 through the first data pad contact hole 161 are formed.

Next, as shown in FIG. 5c, the above-explained insulating material is deposited or coated on the substrate 111 having the patterned pixel electrode 163 et al. to form a second passivation layer 169. The second passivation layer 169 is patterned to form a second drain contact hole 153` exposing a portion of the pixel electrode 163 contacting the drain electrode 135 and to form a second storage contact hole 157` exposing a portion of the pixel electrode 163 contacting the source-drain metal layer 149.

Subsequently, an opaque conductive metal having good reflectance such as aluminum (Al) and aluminum alloy (AlNd) is deposited on the patterned second passivation layer 169 to form a reflective electrode layer.

Next, a photoresist is coated on the reflective electrode layer and patterned to form a reflective electrode 166. It is formed by wet-etching process exposing a portion of the reflective electrode layer etched out of the reflective electrode layer.

Next, as shown in FIG. 5d, an etching process for the second passivation layer 169 exposed through the etched reflective electrode 166 proceeds. At this point, there are two methods.

In the first method, the reflective electrode 166 is formed, then all the PR layer (not shown) for the reflective pattern are removed, and then the exposed second passivation layer 169 is etched by a dry etching process using the reflective electrode as an etch stopper.

At this time, for the reflective electrode 166, a material having low resistance and good reflectance and not affected by a dry etching is enough.

In the second method, the second passivation layer 169 exposed below the etched reflective electrode layer is dry-etched earlier, and then the PR layer (not shown) remaining on the patterned reflective electrode 166 is removed. In this process, a stripper used generally to remove the PR layer is not used, but an ahsing process is used. The reason is that since the stripper is an electrolyte like an etching solution for an aluminum material, galvanic corrosion occurs between the reflective electrode of an aluminum material and the exposed transparent electrode if the PR layer is removed by a wet etching.

On the contrary, it is possible to remove the PR layer with the stripper if the transparent conductive metal of the pixel is not exposed.

Through the above process, as shown in FIG. 5d, the gate pad terminal electrode 165 contacting the gate pad 129 and the data pad terminal electrode 167 contacting the data pad 142 are exposed using the dry etching process.

Through the above processes, an array substrate for the transflective LCD device according to the first embodiment of the present invention can be fabricated. In the method of the first embodiment, it is an effect that galvanic corrosion does not occur between the transparent electrode and the reflective electrode. Furthermore, it is an advantage that processes are simplified because separate mask process is not used to expose the gate pad terminal electrode and the data pad terminal electrode as the transparent electrodes.

-- Second embodiment --

Hereinafter, with reference to FIGs. 6a to 6c, a second embodiment of the present invention will be explained.

Since a plane structure of FIG 6a is equal to that formed through process of FIGs 5a to 5d, explanations will be simplified.

As shown in FIG 6a, a thin film transistor T includes a gate electrode 132, an active layer 145, a source electrode 133 and a drain electrode 135.

A gate line 125 connected to the gate electrode and including a gate pad 129 at one end thereof is formed. Furthermore, a data line (not shown) connected to the source electrode 133 and including a data pad 142 at one end thereof is formed.

At this time, in forming process of the source electrode 133 and the drain electrode 135, a source-drain metal layer 149 having island-shape over a portion of the gate line 125 defining the pixel region (P in FIG 3) is formed. One of organic insulating material group including benzocyclobutene and acrylic resin is deposited on the substrate 111 having the thin

film transistor T and patterned to form a first passivation layer 151 including a first drain contact hole 153, a etching hole 155, a first storage contact hole 154, a first gate pad contact hole 159 and a first data pad contact hole 161.

A transparent conductive metal is deposited on the first passivation layer 151 and patterned to form a transparent pixel electrode 163, a gate pad terminal electrode 165 and a data pad terminal electrode 167. The pixel electrode 163 contacts the drain electrode 135 through the first drain contact hole 153 and the source-drain electrode 149 through the first storage contact hole 154 at the same time. The gate pad terminal electrode 165 contacts the gate pad 129, and the data pad terminal electrode 167 contacts the data pad 142.

Next, as shown in FIG. 6b, an inorganic insulating material or one of an organic insulating material group is deposited on the substrate 111 having the patterned transparent electrode 163 and patterned to form a second passivation layer 169. The inorganic insulating material includes silicon nitride (SiN_X) and silicon oxide (SiO_2) et al.. The organic insulating material group includes benzocyclobutene and acrylic resin et al.. The second passivation layer 169 is patterned to form a second drain contact hole 153` exposing the transparent electrode 163 contacting the drain electrode 135 and to form a second storage contact hole 154` exposing a portion of the source-drain metal layer 149.

At the same time, a gate pad contact hole 171 and a data pad contact hole 172 exposing the gate pad terminal electrode 165 and the data pad terminal electrode 167, respectively, are formed.

Next, a conductive metal having a strong corrosion resistance such as chromium (Cr) is deposited on the substrate 111 having the patterned second passivation layer 169 to form a first reflective electrode layer 166`. Subsequently, one of a conductive metal group having a

low resistance and a good reflectance such as aluminum (Al) and aluminum alloy (AlNd) is deposited on the first reflective electrode layer to form a second reflective electrode layer 168\`.

Next, the second reflective electrode layer 168\` of aluminum or aluminum alloy is etched using an acid-mixed solution (a mixed etching solution of phosphoric acid (H_3PO_4), acetic acid (CH_3COH) and nitric acid (HNO_3)).

Subsequently, when the first reflective electrode layer 166\` is made of chromium (Cr), it is etched using an etching solution mixed with ceric ammonium nitrate acid.

At this time, when the second reflective electrode layer 168\` is patterned, the first reflective electrode layer 166\` plays a part to protect the gate pad terminal electrode 165 and the data pad terminal electrode 167 against the etching solution for aluminum.

Through the above process, as shown in FIG. 6c, the first reflective electrode layer (166\` in FIG. 6b) and the second reflective electrode layer (168\` in FIG. 6b) become a first reflective electrode 166 and a second reflective electrode 168 which have a through-hole A at the same position.

In the above process, the first reflective electrode 166 and the second reflective electrode 168 are sequentially stacked on the gate pad terminal electrode 165 and the data pad terminal electrode 167 as transparent electrodes. However, since the second reflective electrode not causing galvanic corrosion with the transparent terminal electrodes is patterned after the first reflective electrode causing galvanic corrosion with the transparent electrode using the etching solution is etched earlier, galvanic corrosion does not occur in the process of exposing the gate pad terminal electrode and the data pad terminal electrode.

Furthermore, since separate mask process to expose the gate pad terminal electrode and the data pad terminal electrode is not necessary, it is an effect that processes are simplified.

-- Third embodiment --

A third embodiment of the present invention provides a structure omitting a first passivation layer between the transparent electrode and the reflective electrode. At this time, the reflective electrode has a double-layered structure of chromium (or titanium)/aluminum, galvanic corrosion between the transparent electrode and the reflective electrode including aluminum is prevented using selective etching characteristic, and processes are simplified.

Hereinafter, with reference to FIGs. 7a to 7c, a third embodiment of the present invention will be explained in detail.

FIGs. 7a to 7c are sequential processing cross-sectional views take along lines II-II`, III-III` and IV-IV` of FIG. 3.

(Since processes of FIGs 7a to 7c are similar to that of FIGs. 5a to 5d of the first embodiment, detail explanations will be omitted.)

At first, as shown in FIG. 7a, a thin film transistor T includes a gate electrode 132, an active layer 145, a source electrode 133 and a drain electrode 135.

At this time, in forming process of the source electrode 133 and the drain electrode 135, a source-drain metal layer 149 having island-shape over a portion of the gate line 125 defining the pixel region (P in FIG. 3) is formed. One of organic insulating material group including benzocyclobutene and acrylic resin is deposited on the substrate 111 having the thin film transistor T and patterned to form a passivation layer 151 including a drain contact hole 153, a etching hole 155, a storage contact hole 154, a gate pad contact hole 159 and a data pad contact hole 161.

A transparent conductive metal is deposited on the first passivation layer 151 and patterned to form a pixel electrode 163, a gate pad terminal electrode 165 and a data pad

terminal electrode 167. The pixel electrode 163 contacts the drain electrode 135 through the drain contact hole 153 and the source-drain electrode 149 through the storage contact hole 157.

Next, as shown in FIG. 7b, chromium is deposited entirely on the substrate 111 having the pixel electrode 163 et al. to form a first reflective electrode layer 166`. Subsequently, aluminum or aluminum alloy is deposited to form a second reflective electrode layer 168` overlapping in plane the first reflective electrode layer 166`. Accordingly, a double-layered reflective electrode of chromium (Cr) (or molybdenum (Mo))/aluminum alloy (AlNd) (or aluminum (Al)) is formed.

To pattern the double-layered reflective electrode layers 166` and 168`, photolithography process proceeds that a photoresist (PR) (not shown) 167 is coated on the double-layered reflective layers, then light-exposing process proceeds, then the light-exposed portion of the photoresist is stripped, and thus the lower metal layer to be etched (the second reflective electrode layer) is exposed.

At this time, the lower aluminum alloy (aluminum) as the second reflective electrode layer exposed through the PR layer 167 is etched using a acid-mixed solution (a mixed etching solution of phosphoric acid (H_3PO_4), acetic acid (CH_3COH) and nitric acid (HNO_3)).

Next, chromium (Cr) exposed below the etched aluminum alloy layer is etched using an etching solution mixing ceric ammonium nitrate and nitric acid.

Like this, the reason for forming the reflective electrode of a double-layered and double-etching is that galvanic corrosion between aluminum and the transparent therebelow is protected against the etching solution for aluminum.

It is preferable that the metal layer as the second reflective electrode layer below the aluminum layer has a thickness enough to prevent penetrating the etching solution for aluminum into the lower transparent electrode.

In general, for chromium and the transparent electrode, phenomenon such as plucking-out of the layer from galvanic by the etching solution does not occur. Therefore, the first reflective electrode layer 166a of acts as protecting layer to protect the transparent electrode against the etching solution etching aluminum.

Therefore, as the first reflective electrode layer, all the opaque metals including chromium (Cr) and molybdenum (Mo) not causing galvanic corrosion with the transparent electrode are used.

As shown in FIG. 7c, the above etching process is finished and a removing process of the remaining PR layer proceeds, and thus a double-layered reflective electrode 166 having a through-hole is formed on the pixel region (P in FIG. 3).

Therefore, a transflective pixel electrode 169 including the transparent metal 163 and the double-layered opaque metal 166 and 168 can be formed.

In the above structure, since the transparent electrode 163 and the double-layered reflective electrode contact each other in entire surface, the process for preventing the defects trapping electrons at a interface between the two electrodes is necessary.

Therefore, when a laser treatment proceeds after the transparent electrode material is deposited, a amorphous transparent electrode has the same electric and optic characteristics as a poly-crystalline transparent electrode.

As other example of the method that galvanic corrosion between the transparent electrode 163 and the reflective electrode 166 and 168 is prevented and processes is simplified, the method that the reflective electrode has a single layer and is thick and it is etched by a dry etching is used.

As explained in detail, an opaque metal having a good reflectance is deposited thickly on the transparent electrode, and then a photolithography process proceeds.

At this time, the reflective electrode exposed through the PR layer is etched about half with a dry etching, and then the remaining PR layer is stripped.

In the above process, the reason for etching a portion of the reflective electrode at first is that the transparent electrode is not exposed with the etching solution during removing the PR layer since a stripper for the PR is an electrolyte.

When the reflective electrode is etched with a dry etching after the PR is stripped, all the partially residual reflective electrode are removed. To be sure, in this process, the reflective electrode in the pixel region is etched partially from the surface, however, it is not unreasonable to act as the reflective electrode.

The above method has an advantage that separate process opening the gate pad and the data pad is not necessary, as compared with the conventional art.

Using the methods of the above first, second and third embodiments, the transflective LCD device according to the present invention is fabricated.

[EFFECT OF INVENTION]

Therefore, the transflective LCD device according to the present invention has a structure that galvanic phenomenon does not occur when the reflective electrode and the transparent electrode constituting the transflective electrode are patterned, and has an effect that processes are simplified and thus costs are reduced since separate mask process exposing the gate pad and the data pad is not necessary.

[RANGE OF CLAIMS]

[CLAIM 1]

A fabricating method of an array substrate for a liquid crystal display device, comprising:

preparing a substrate;

forming a thin film transistor on the substrate including a gate electrode, a source electrdoe, a drain electrode and an active layer;

forming a data line extended from the source electrode and having a data pad at an end thereof;

forming a gate line extended from the gate electrode and having a gate pad at an end thereof;

depositing an insulating material on the substrate having the data line to form and pattern a first passivation layer, thereby forming a drain contact hole exposing the drain electrode, a gate pad contact hole exposing the gate pad and a data pad contact hole exposing the data pad;

depositing and patterning a tranparent electrode on the first passivation layer, thereby forming a pixel electrode contacting the drain electrode through the drain contact hole at one side thereof, a gate pad terminal electrode contacting the gate pad through the gate pad contact hole and a data pad terminal electrode contacting the data pad throught the data pad contact hole;

forming and patterning a second passivation layer of an insulating material on the patterned transparent electrode, thereby exposing a portion of the pixel electrode contacting the drain electrode;

forming a reflective electrode having a through-hole on the second passivation layer over the pixel electrode and contacting the exposed pixel electrode; and

etching the exposed second passivation layer using the reflective electrode as an etching stopper, thereby exposing the gate pad terminal electrode and the data pad terminal electrode.

[CLAIM 2]

The fabricating method according to claim 1, wherein the transparent electrode is one selected of a transparent conductive metal group including indium-tin-oxide and indium-zinc-oxide.

[CLAIM 3]

The fabricating method according to claim 1, wherein the reflective electrode is one selected of a conductive metal group including aluminum (Al) and aluminum alloy (AlNd) having a good reflectance and a low resistance.

[CLAIM 4]

The fabricating method according to claim 1, further comprising etching the passivation layer at a position corresponding to the thorugh-hole of the reflective electrode.

[CLAIM 5]

The fabricating method according to claim 1, wherein the etching process of the second passivation layer to expose the gate pad terminal electrode and the data pad terminal electrode is a dry etching process.

[CLAIM 6]

An array substrate for a transflective liquid crystal display device, comprising:

a substrate;

a gate line and a data line on the substrate crossing each other to define a pixel region and including a gate pad and a data pad, respectively;

a switching element at the cross of the gate line and the data line;

a transflective pixel electrode including a transparent electrode on the pixel region and a double-layered reflective electrode on the transparent electrode including a through-hole and having a first layer not reacting with the transparent by an etching solution; and

a passivation layer below the transparent electrode, a portion of the passivation layer corresponding to the through-hole etched with a predetermined depth.

[CLAIM 7]

The array substrate according to claim 6, further comprising a second passivation layer of an insulating layer between the transparent electrode and the reflective electrode.

[CLAIM 8]

A fabricating method of an array substrate for a liquid crystal display device, comprising:

preparing a substrate;

forming a thin film transistor on the substrate including a gate electrode, a source electrdoe, a drain electrode and an active layer;

forming a data line extended from the source electrode and having a data pad at an end thereof;

forming a gate line extended from the gate electrode and having a gate pad at an end thereof;

forming and patterning a passivation layer of an insulating material on the substrate having the data line, thereby forming a drain contact hole exposing a portion of the drain electrode, a gate pad contact hole exposing the gate pad and a data pad contact hole exposing the data pad;

depositing and patterning a tranparent electrode on the passivation layer, thereby forming a pixel electrode in the pixel region contacting the drain electrode through the drain contact hole at one side thereof, a gate pad terminal electrode contacting the gate pad through the gate pad contact hole and a data pad terminal electrode contacting the data pad throught the data pad contact hole;

depositing and patterning a conductive metal on the patterned transparent electrode having a good reflectance and a low resistance, thereby stacking a first reflective electrode layer on the pixel electrode having a strong corrosion resistance and a second reflective electrode layer on the first reflective electrode layer having a low resistance and a high reflectance; and

etching the first reflective electrode layer and the second reflective electrode layer, respectively, using different etching solutions from each other, thereby forming a reflective electrode including a first reflective electrode and a second reflective electrode stacked on the pixel region including a through-hole, and at the same time exposing the gate pad terminal electrode and the data pad terminal electrode.

[CLAIM 9]

The fabricating method according to claim 8, further comprising forming a passivation layer between the transparetn electrode and the first reflective electrode.

[CLAIM 10]

The array substrate according to claim 8, wherein the first reflective electrode of the double-layered reflective electrode is one selected of a conductive metal group including chromium, molybdenum and tungsten having a strong corrosion resistance.

[CLAIM 11]

The array substrate according to claim 10, wherein the etching solution patterning the first reflective electrode is an acid-mixed solution mixing ceric ammonium nitrate and nitric acid.

[CLAIM 12]

The array substrate according to claim 8, wherein the second reflective electrode of the double-layered reflective electrode is one selected of a conductive metal group including aluminum and aluminum alloy having a good reflectance and a low resistance.

[CLAIM 13]

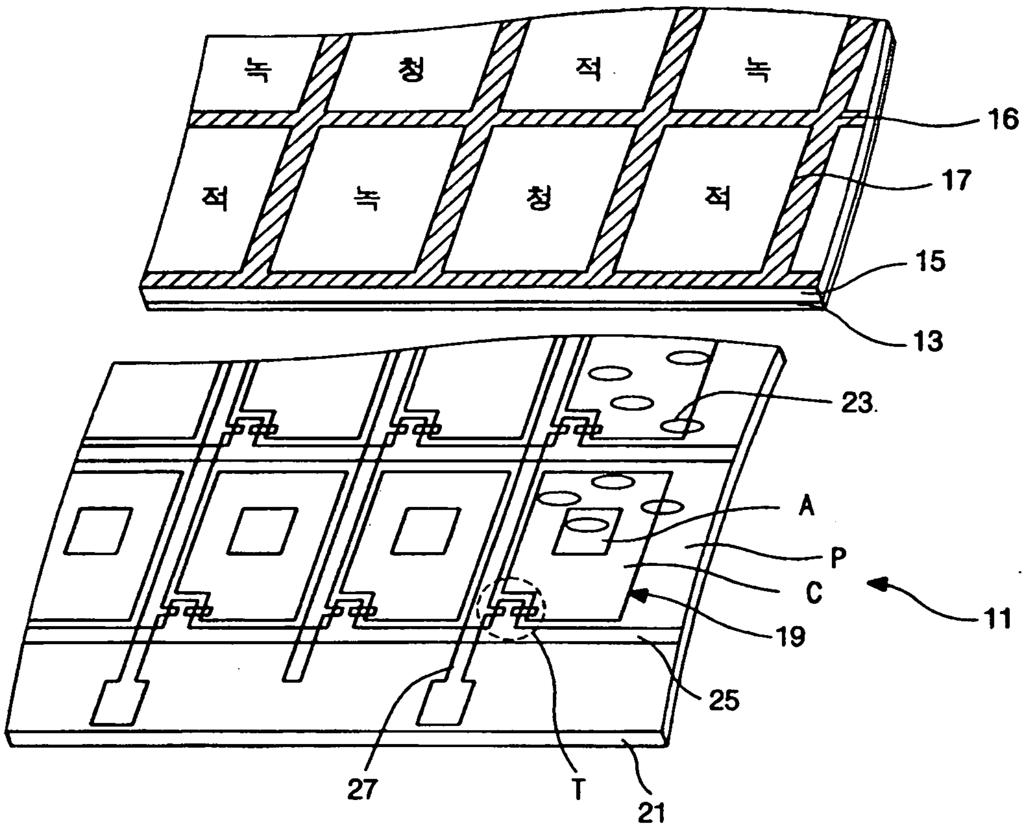
The array substrate according to claim 12, wherein the etching solution patterning the second reflective electrode is an acid-mixed solution of phosphoric acid (H_3PO_4), acetic acid (CH_3COH) and nitric acid (HNO_3).

[CLAIM 14]

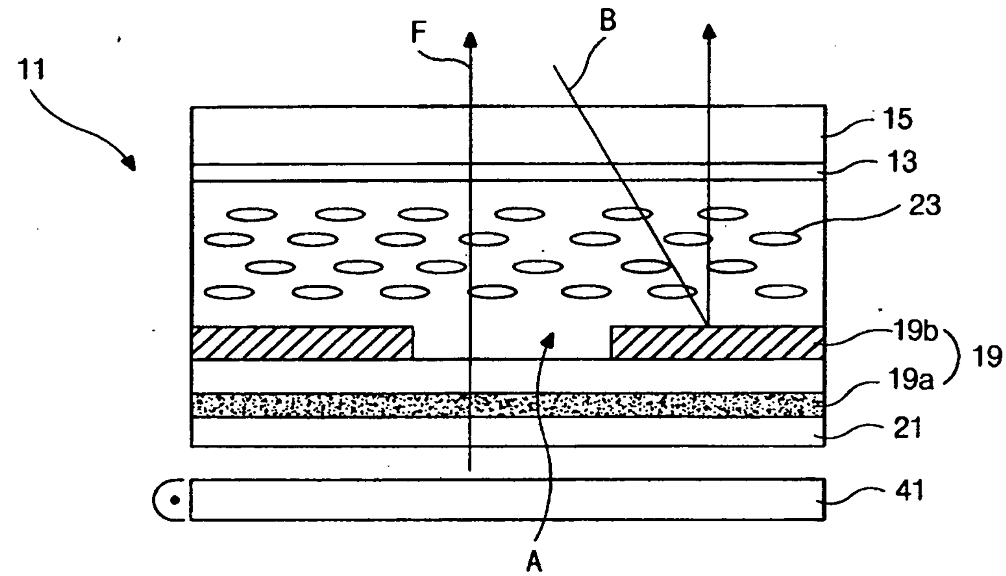
The array substrate according to claim 8, wherein the transparent electrode is one selected of a transparent conductive metal group including indium-tin-oxide and indium-zinc-oxide.

[DRAWINGS]

[FIG. 1]



[FIG. 2]



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19b
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19a
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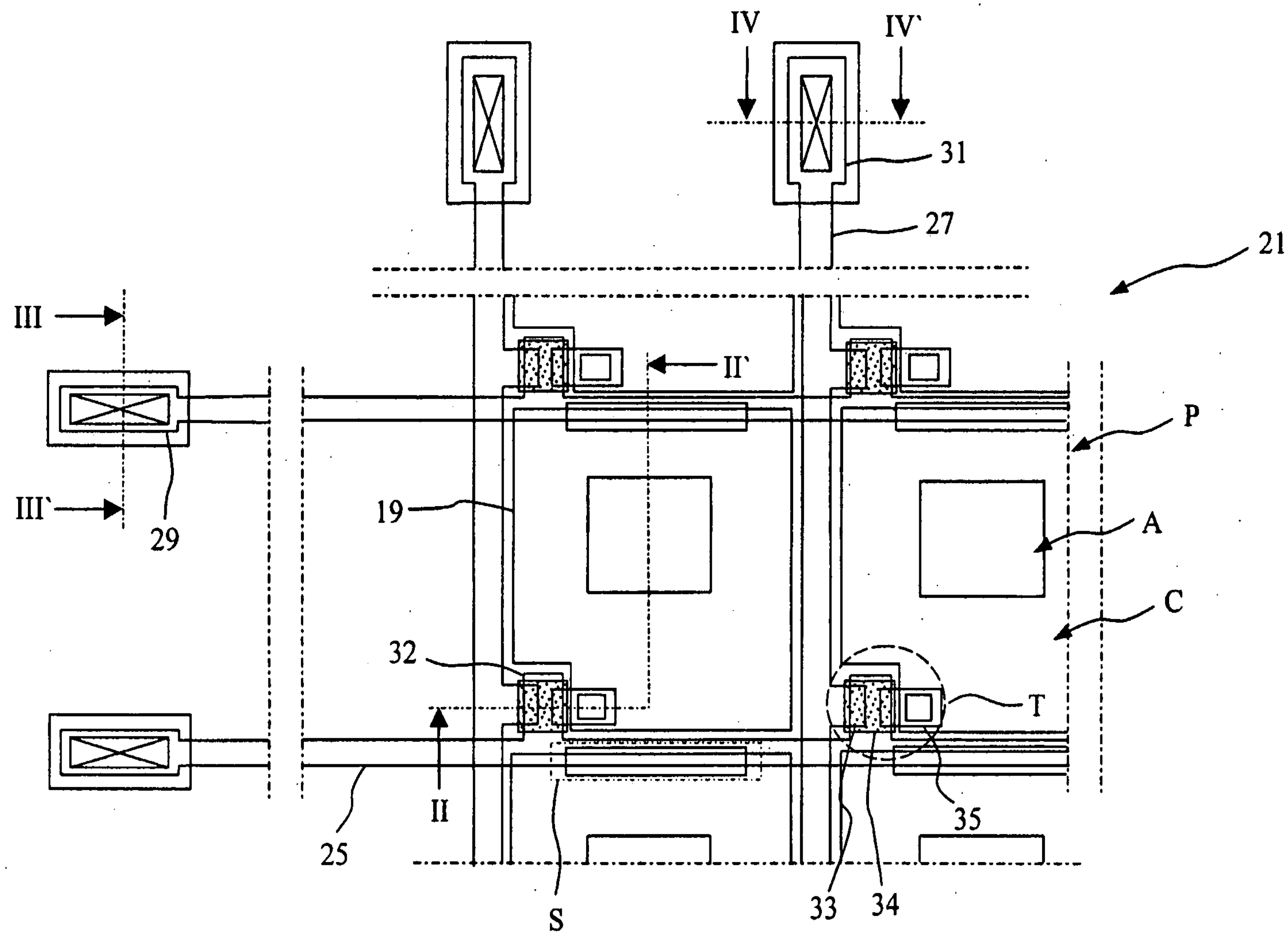
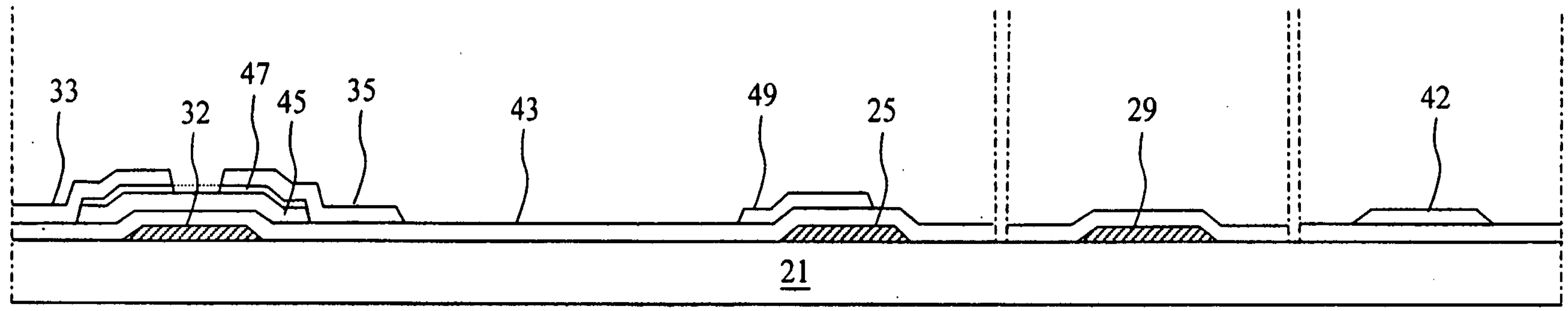
41
A

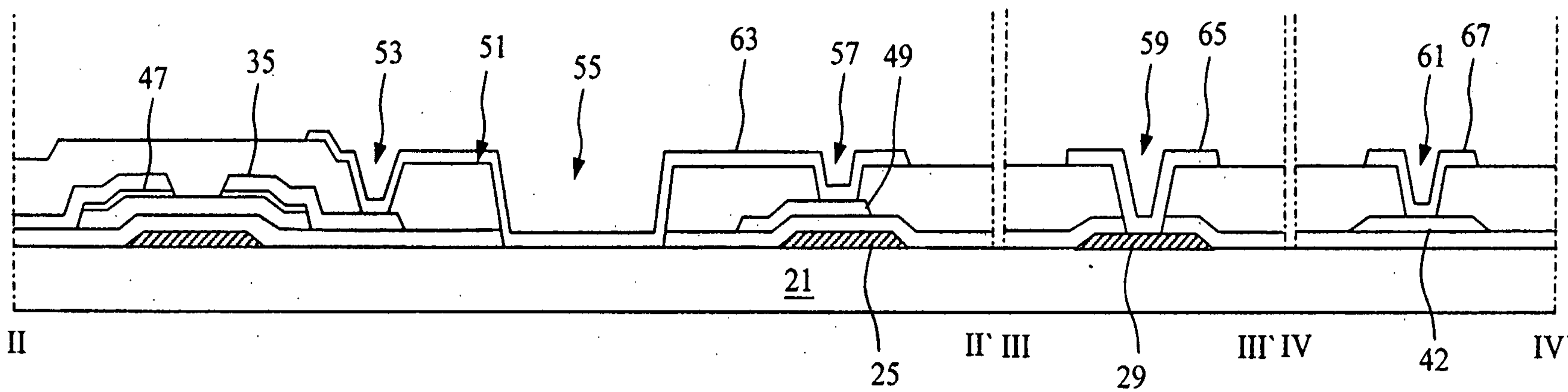
[FIG. 3]



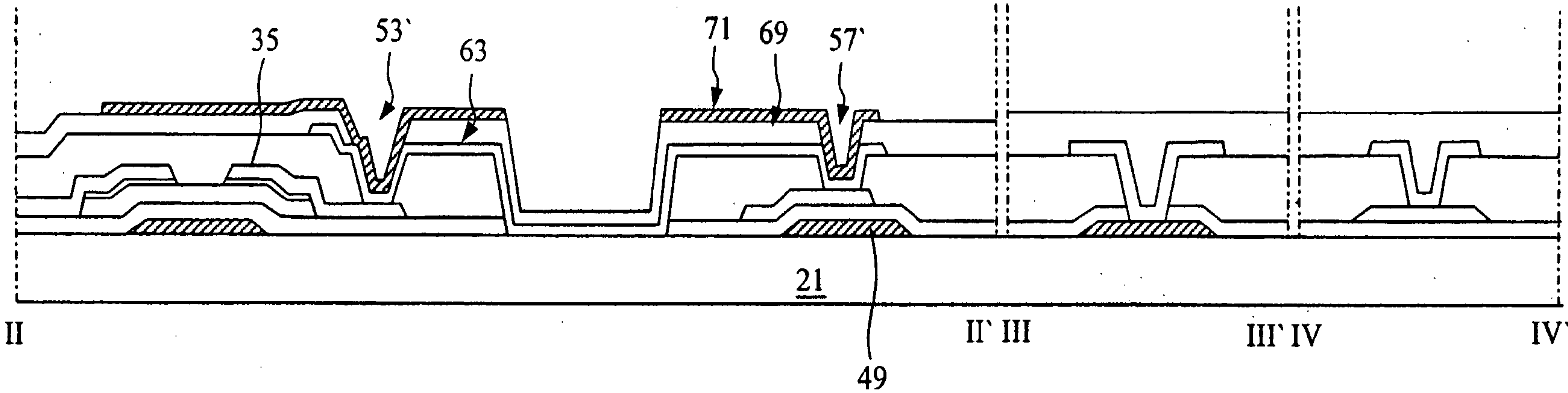
[FIG. 4a]



[FIG. 4b]



[FIG. 4c]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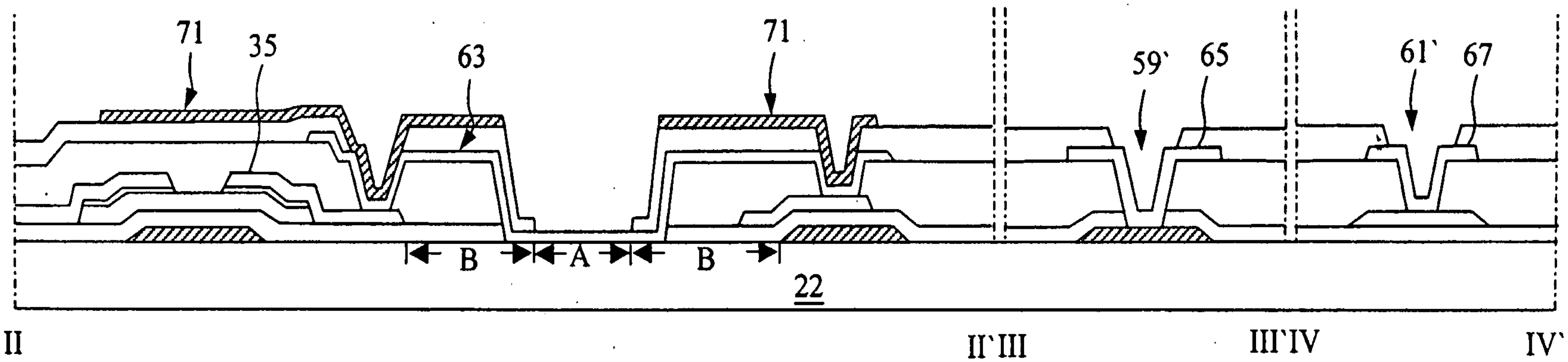
II` III
III` IV
IV`

[FIG. 4d]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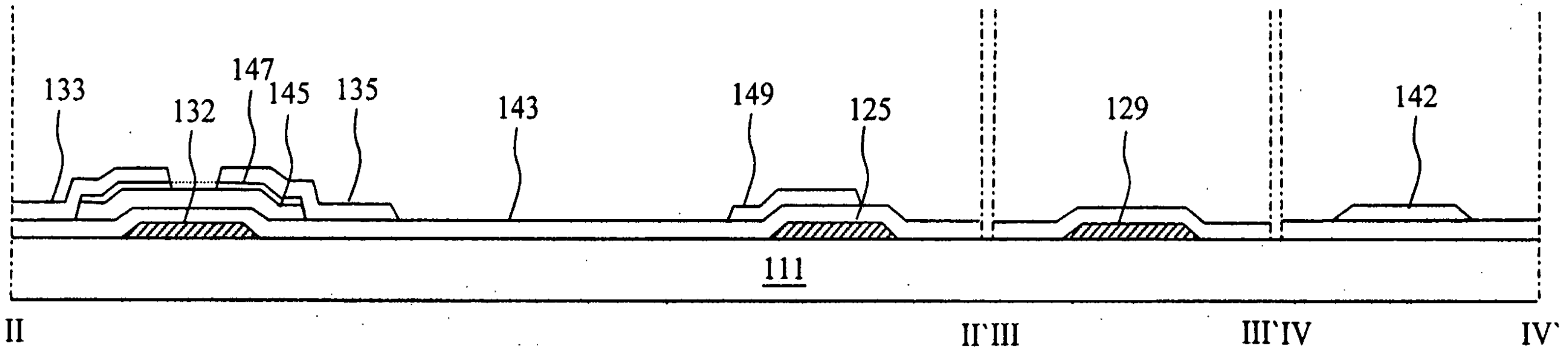
[FIG. 5a]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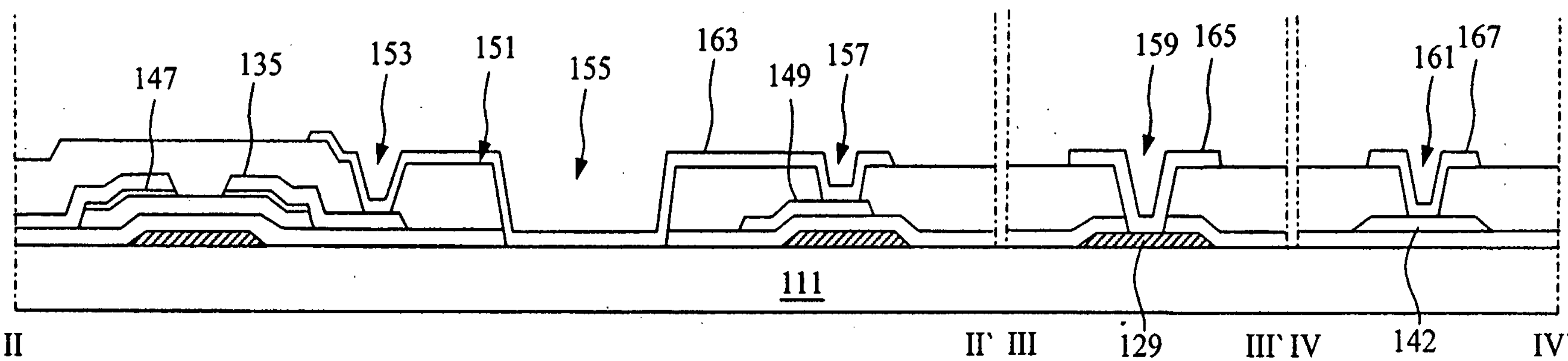
[FIG. 5b]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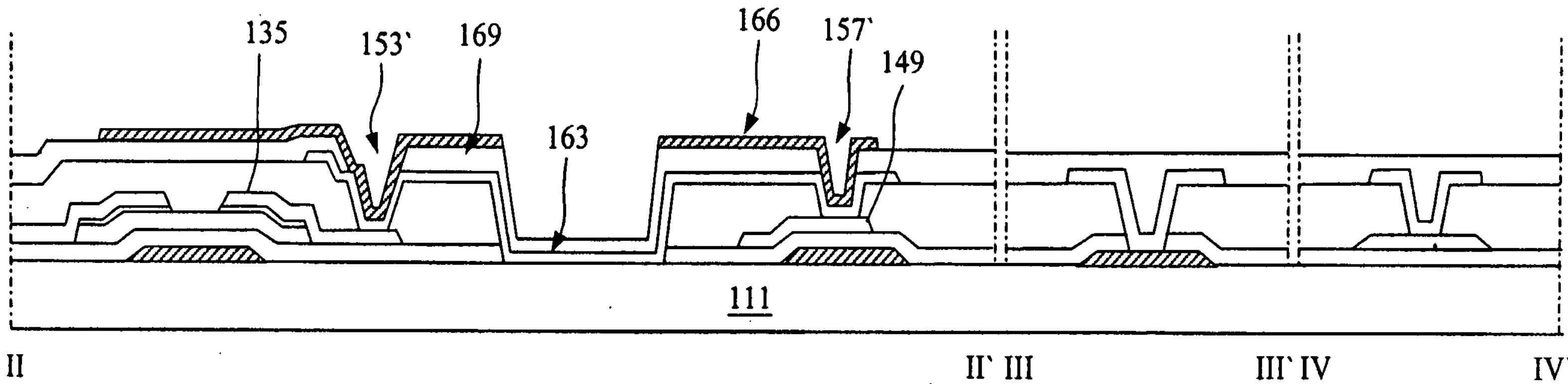
[FIG. 5c]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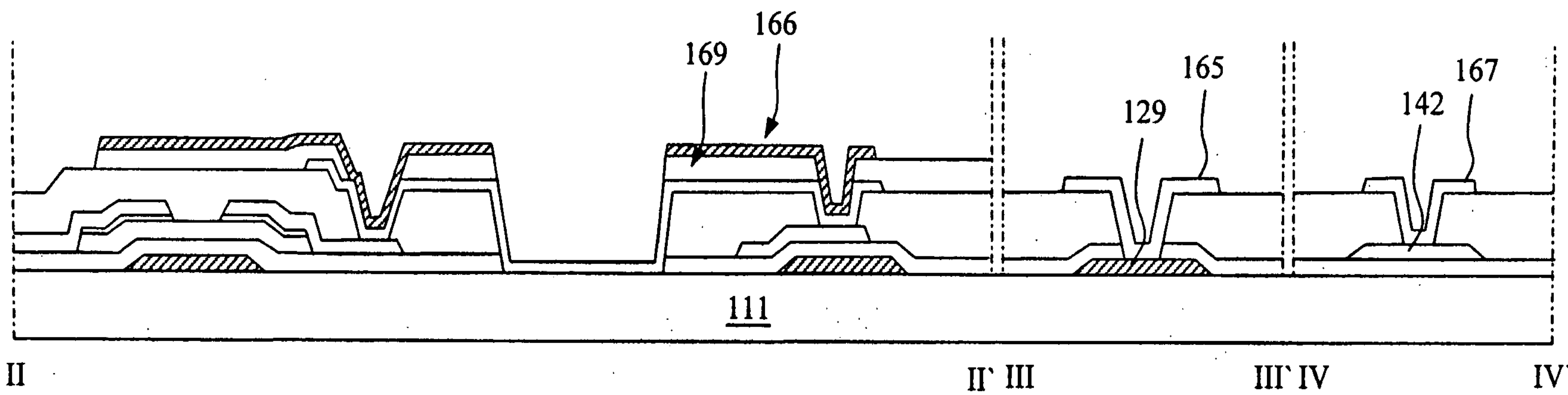
[FIG. 5d]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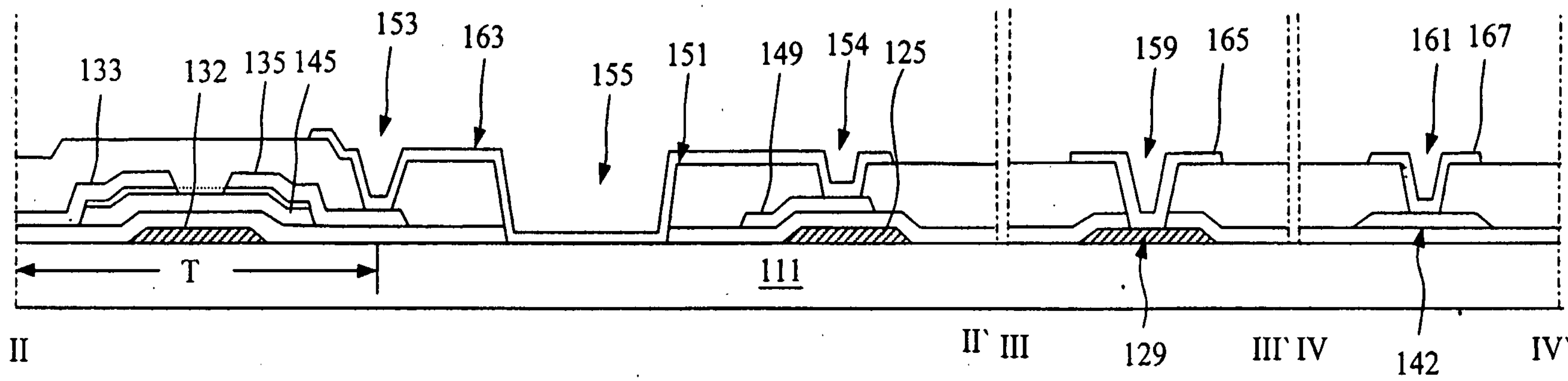
[FIG. 6a]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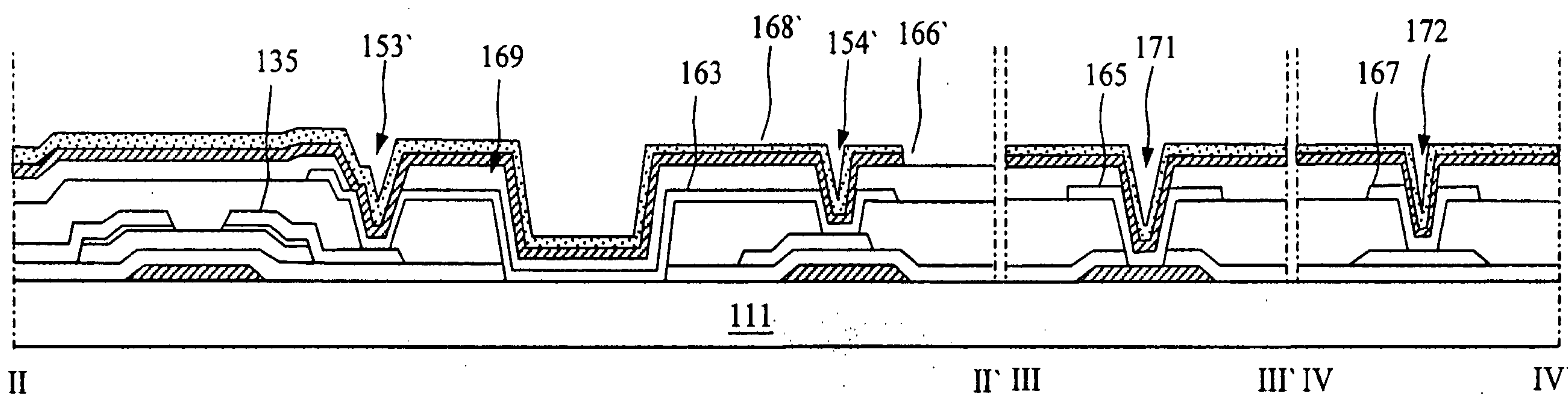
[FIG. 6b]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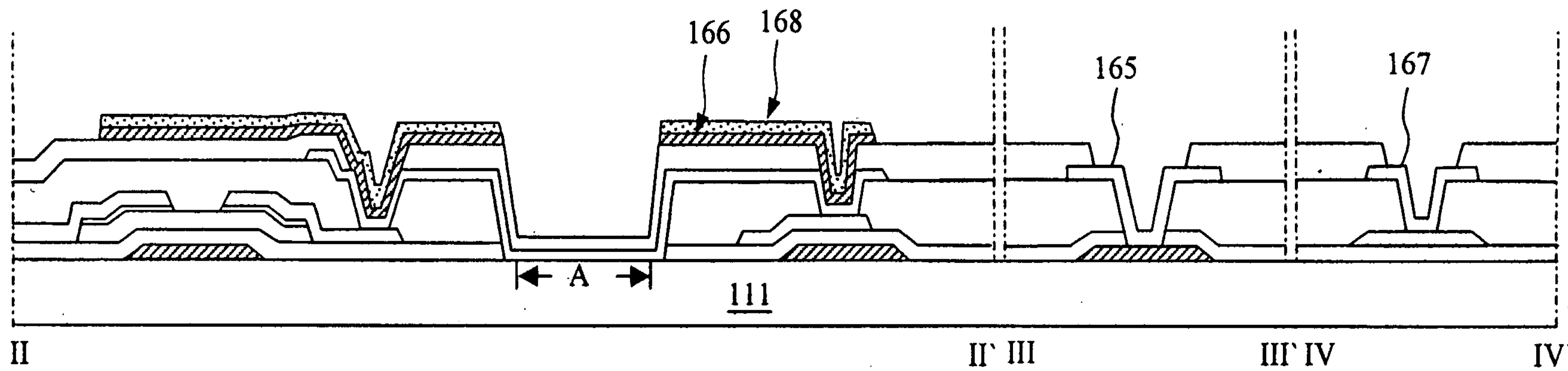
[FIG. 6c]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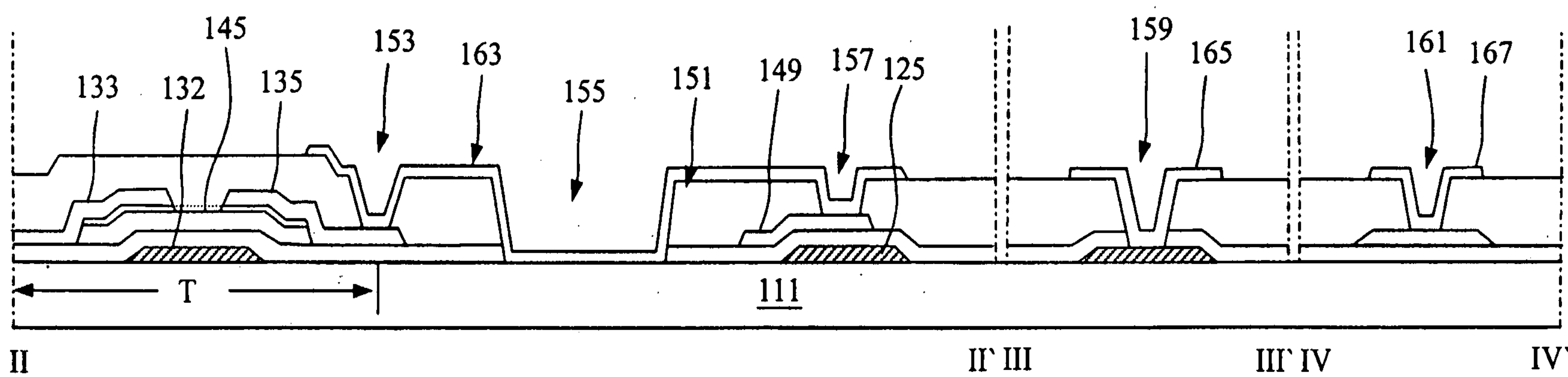
[FIG. 7a]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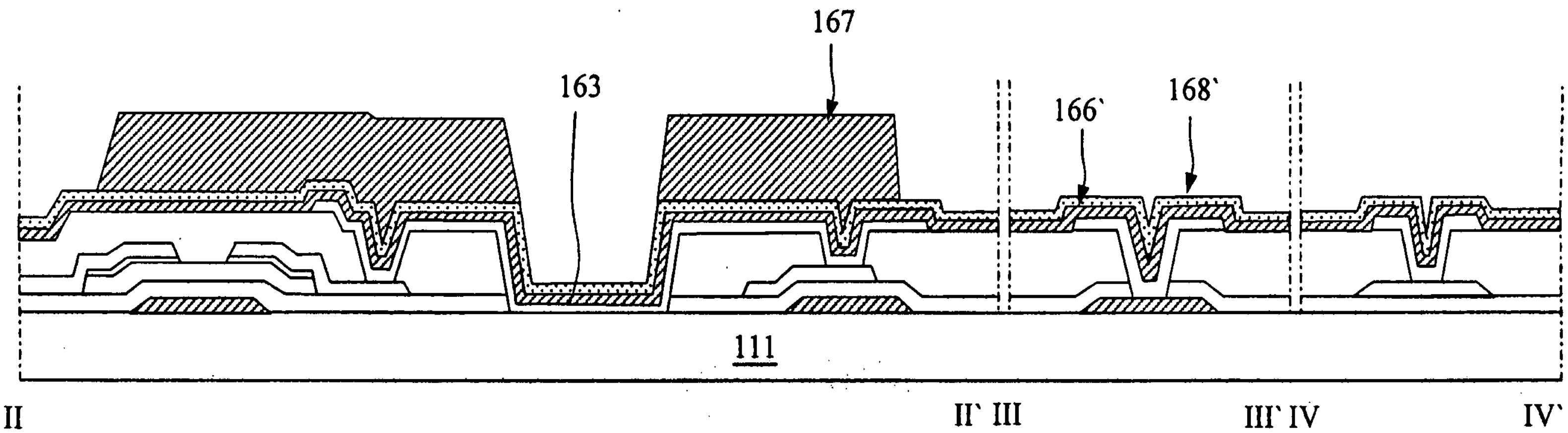
[FIG. 7b]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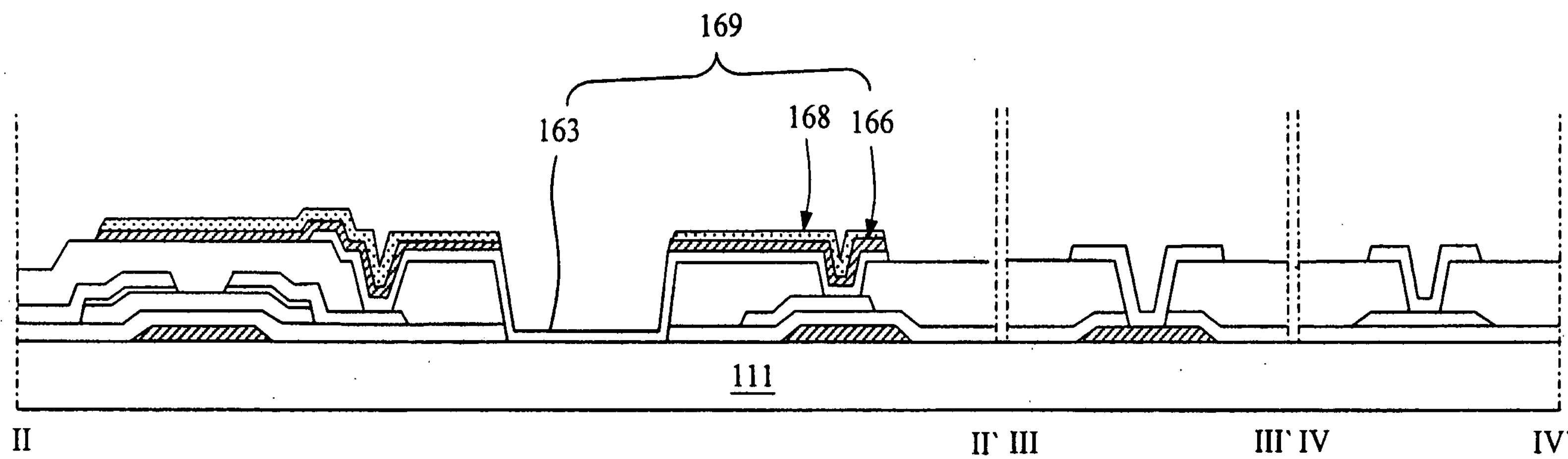
[FIG. 7c]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